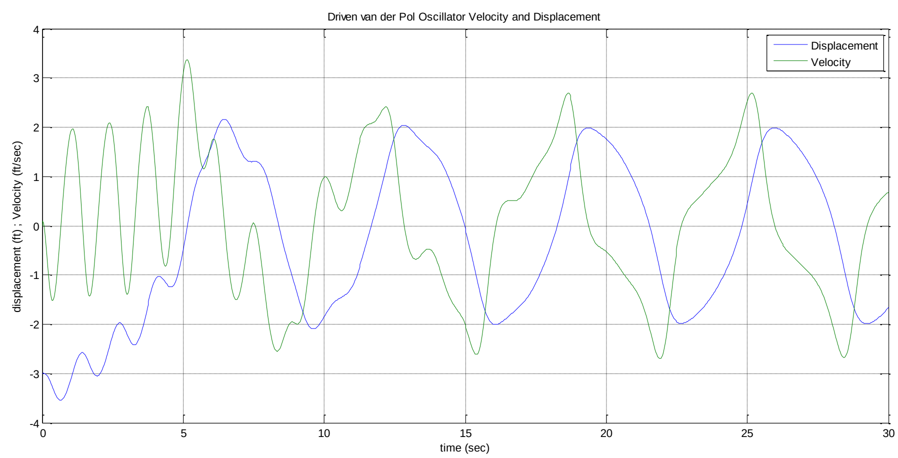
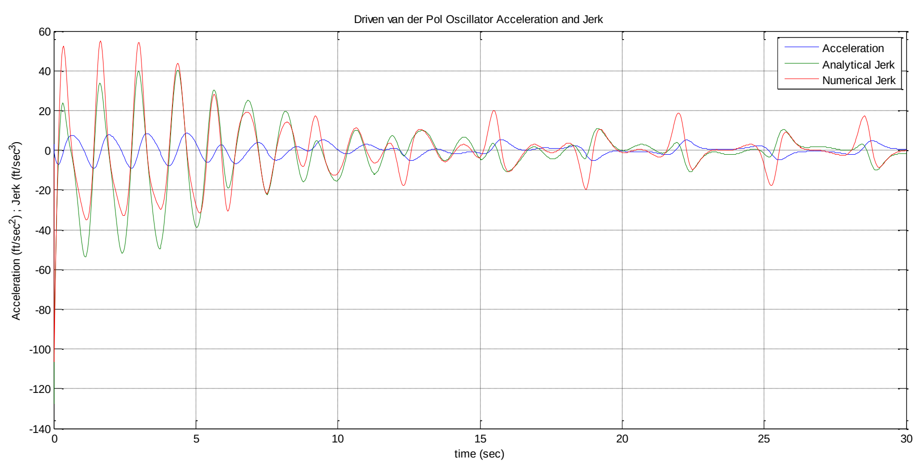
Problem 1: Analytical expression obtained for part b bullet #1 contained on last page of the stapled assignment sheet. For part b bullet #2 centered 3 point differencing equations were used to find the solution.

```
% jerk calculation analytically Problem 1 Part B Bullet 1
 % reset the counter
f1a_t = 4.*exp(-t./5).*sin(5)-100.*exp(-t./5).*cos(5.*t);
for i = 1:1001
    ja(i) = -(x(i)^2-1)*a(i)-v(i)+f1a_t(i);
end

% jerk calculation using centered differencing numerical approximations Problem 1 Part B Bullet 2
i = 1;
jb(i) = a(i+1) - a(i);
for i = 2:1000
    jb(i) = (a(i+1) - a(i-1))/(2*dt);
end
i = i+1;
jb(i) = (a(i)-a(i-1))/(2*dt);
```



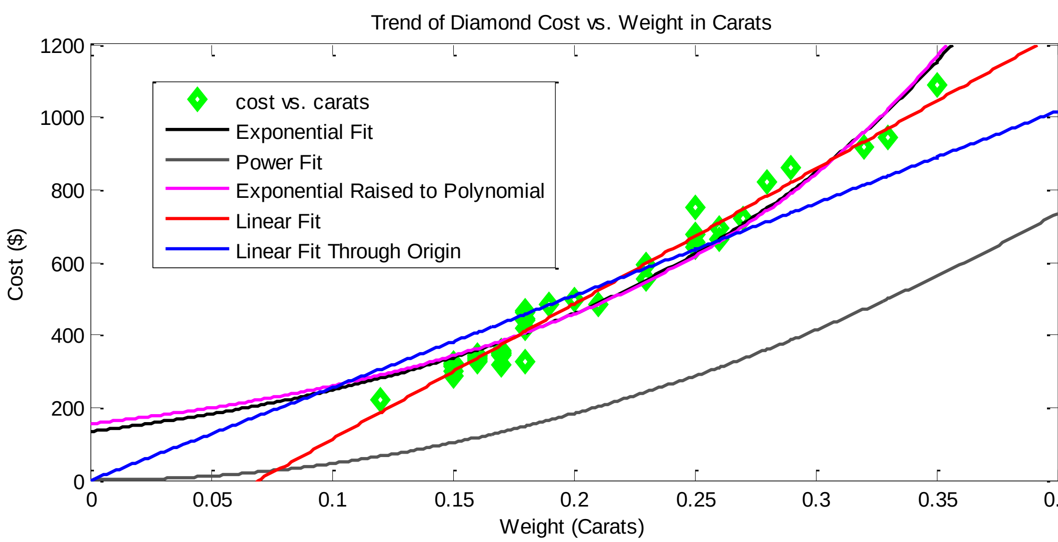


```
% Problem 1 Part C
% Numerical Integration Done Using Trapezoidal Rule
%f(a)
i = 1;
fdash(i) = -(x(i)^2-1)*v(i);
pdash(i) = fdash(i)*v(i);

for i = 1:1000
    fdash(i+1) = -(x(i+1)^2-1)*v(i+1);
    pdash(i+1) = fdash(i+1)*v(i+1);
    wdash(i) = dt*(pdash(i)+pdash(i+1))/2;
end

pdtotal = (wdash(1000)-wdash(1))*30;
```

Final result for the power dissipated by the dashpot over the entire time is -.7067 or

Problem 2:

The linear model fit when solved using the matlab cftool returns a value of 3725 for the slope and -260.3 for the y intercept. This makes sense because when diamonds become too small, they are no longer suitable for rings because the setting becomes worth much than the diamond and the visual appearance of a diamond becomes that less obvious. Therefore before the diamond weighs nothing the value for a diamond to put in a ring becomes 0. Forcing the data through the origin does not help the fit and makes the fit only reasonable between ~.175 carats and ~.275 carats instead of the whole range.



Sensibility of Non-Linear Fits:

- Power Fit: The power fits neither the higher or lower sizes of diamonds with a starting value at the origin which doesn't make sense for diamonds for rings.
- Exponential Fit: The exponential fit is far better than both the power and linear fit through the origin. Also, the exponential is closer to more values than the exponential

raised to a polynomial. For both the highest and lowest values, it comes fairly close in the fitting.

- Exponential Raised to a Polynomial: This fit works decently well, but doesn't make much sense to use because a simple exponential equation fits better than this complicated exponential. For both the highest and lowest values, it comes fairly close in the fitting.

None of the non-linear fits come as close to the majority of values as does the straight linear fit of the data.